History of the Department of Physics at UWA

Issue No. 5: "The Beginning of Research"

Presented by John L. Robins

Introduction.

Following the move in 1935 to the new Physics and Chemistry Building at Crawley, there was an expectation that research activities would increase. However, the Second World War, which lasted from 1939 to 1945, prevented this. It was only after the war that research activities developed both in depth and variety of subject.

The first report below is taken from the Australian Physicist and is a continuation of the article started in Issue No. 2. It continues the story up to 1951, which is the year when A.D. Ross handed over to C.J.B. Clews as Professor of Physics. It chronicles not only the research activity but also the recruitment and changes of academic staff.

The second article below is an extract from "Campus at Crawley". It is a very abbreviated history of the Department covering roughly the same period up until 1962, the end of the University's first 50 years.

Sources.

The first report below is an extract from an article by S.E. Williams and J.B. Swan, published in the "Australian Physicist", Vol. 13, pp 20-22, February 1976. The article was a review of Physics in The University of Western Australia, covering the period from 1913 to 1951, with an emphasis on the contribution of Professor A.D. Ross. The section presented here continues on from that which was presented earlier in Issue No. 2.

The second article is an extract from "Campus at Crawley" by Fred Alexander (1953), which is an historical tome of 875 pages presenting 'A narrative and critical appreciation of the first fifty years of The University of Western Australia'. The present extract (pages 436 to 438), presents his overview of research within the Physics Department up until about 1962.

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An Extract from

PHYSICS AT THE UNIVERSITY OF WESTERN AUSTRALIA, 1913-1951

Professor A. D. Ross, CBE, MA, DSc, FRAS, FRSE, F Inst P, FAIP

Authors: S. E. Williams & J. B. Swan,
Department of Physics,
University of Western Australia.

[Continuing the story.]

In 1934 the state government provided [the University with] $70,000 for a building to house Chemistry and Physics [at Crawley], and its opening in late 1935 ushered in a new stage. At last there was adequate teaching space, together with a workshop and research laboratories for the staff. During this year Shearer was on study leave at Uppsala with Siegbahn, resuming the work on accurate X-ray wavelengths which he had started with Laby in 1927. On returning he found the technical difficulties too great to continue his work in soft X-rays, and with the encouragement of the soil scientists turned to powder techniques for X-ray analysis, supervising Lucie Taylor's research. Shearer continued active work in this field until his retirement at the end of 1962. Nimmo took leave at Birmingham in 1936, and after his return resigned to rejoin Oliphant and work on the Birmingham cyclotron. V. D. Hopper replaced Nimmo during 1939 but returned to work with Laby and was replaced by S. E. Williams in 1940.

THE WAR YEARS

At the beginning of the Second World War there were about 90 first years students, 25 second year and 8 third year, with perhaps one honours student each year. Ross, who was immersed in teaching and administration, gave about 200 lectures a year, but did find time in 1939 to make observations of ionospheric effects on the variable-frequency radio transmissions from Watheroo. The two lecturers [J. Shearer and S. E. Williams] supervised all laboratory classes. W. F. Cole was the sole research student, working with Shearer. Williams prepared to continue investigating gaseous absorption in the vacuum ultra-violet in connection with the effects of solar flares on the upper atmosphere. Everson ran the workshop alone, being equally skilled in woodworking, metalworking and electrical installation. He was the doyen of the University's technical staff and unsurpassed as a source of information on practical matters. By 1941 the Department was increasingly involved with optical munitions work. Ross, as Chairman of the State Camouflage Committee, had a team of artists and model makers occupying one lecture room. Everson, who by then had two assistants, made simple engraving devices (with which academic staff attempted to rule graticules) and grinding tables and spherometers which were used to produce spherical test gauges. In the later war years the reconditioning of binoculars, manufacture of graticules, construction of an artillery sighting instrument and polishing of lens gauges occupied both academic and workshop staff, as well as about 25 women assistants.

Prior to 1942 there had been no honours lecture courses, but a group of four in that year, comprising C. A. R. Ramm (later at Birmingham, CERN and Melbourne), and L. N. D. Lucas

(now [1976] Director of the Electron Microscopy Centre at the University of Western Australia), J. Crouchley (University of Queensland) and H. F. Pollard (CSIRO and University of New South Wales), led to the introduction of systematic class discussions. In the following year Ramm, who was employed in the optical munitions annex, undertook as a project for his MSc the construction of a klystron, working with the sole help of the Varians' original paper. Having made it work at about one GHz (which satisfied the examiners), revelations of the developments in this field during the war years came as something of a surprise. Lucas, who was in charge of pyrometric standardisation services, constructed an electron diffraction unit for his MSc. Pollard completed an MSc externally at the National Standards Laboratory, as did J. L. Farrant at the Commonwealth X-ray and Radium Laboratory prior to his development of electron microscopy at CSIRO.

THE BEGINNING OF RESEARCH

X-ray diffraction resumed at the end of the war with the help of a large high-tension unit acquired about 1940 from Royal Perth Hospital, and K. Norrish, who later joined the CSIRO Division of Soils, did an MSc under Shearer's supervision. Ramm and Lucas were appointed lecturers in 1945 and 1946, respectively, and Elsie York a graduate assistant in 1947. Following the January 1946 seminar at the Radiophysics Laboratory, Williams set up a 75 MHz receiver to record radio emissions from the Sun and in 1948 supplemented it with a Hale spectrohelioscope for visual detection of solar activity. In 1948 a normal incidence vacuum spectrometer was constructed and this was brought into operation during 1949 whilst on study leave at Edlen's laboratory in Lund. (An attempt to work in the vacuum ultraviolet at Sydney before the war was severely handicapped by an almost complete absence of reference material on this subject in Australia, making even the identification of spectrum lines a hazardous task.) In 1950, after returning to Perth, photoelectric detection of VUV spectra was introduced with the help of students (J. H. Bolton, the late K. M. Burrows, and Noel White).

Ross had succeeded in having a new 2-storey wing built for expanded first and second year laboratories in 1947, from the reconstruction funds then available. He also acquired two Dobson ozone spectrophotometers from the RAAF and observations were started by Cecilia Leary, but wartime use had left the instruments in very poor mechanical condition and they were later relinquished to CSIRO. Ionospheric studies, supported by the Radio Research Board, also formed part of the Department's activities for a few years after the war; R. E. Price (WAIT) completed an MSc while working with E. T. Robinson.

Ramm left for Birmingham at the end of 1947, and about twelve months later Lucas went to Imperial College as a Gledden Fellow. Shearer took study leave in 1948, and P. M. Jeffrey and J. B. Swan joined the staff. The latter supervised and developed the study of cosmic rays (which had been initiated by a postgraduate student, H. Turner) until going on leave in 1951. Jeffrey, with A. H. Morton (Australian National University) constructed a proton source as a prelude to a D-D neutron source, but they were diverted towards mass spectrometry by a discussion with Sir Marcus Oliphant who visited the Department in 1950.

Though for many obvious reasons Ross had been prevented from any major personal involvement in research, and during his long span as Professor published only a few papers in local journals, he fostered the research of others to the fullest possible extent. The technical and financial handicaps were considerable. A modest annual sum was provided by CSIRO, and J. Shearer in 1928 was one of the first recipients, but University funds for research were

not available until the Commonwealth Government initialed a block grant in l936. Dry ice was made on request by the Swan brewery, liquid air was available from CIG and used mainly for radon preparation, and vacuum work in the early forties utilized oil diffusion pumps made by Nimmo. Gradually the workshop staff was expanded and the equipment improved; J. Budge (now [1976] Chief Technician) joined the staff as an apprentice at the end of 1947, but the first electronics technician did not appear till after 1951.

In 1951 Ross took leave prior to retirement. His normal retiring year would have been 1946 but this had been extended for five years. In 1952 he was succeeded by C. J. B. Clews who had worked in X-ray diffraction fields at Cambridge and NPL. In his inaugural address Clews, paying tribute to Ross for building a department having good undergraduate teaching, indicated that the next task was to build a modern graduate school of research. With increased funds and expanded facilities this became possible.

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An Extract from

CAMPUS AT CRAWLEY

Academic Achievement: Research in Physics from 1929 to 1962

From 1929 onwards [within the Department of Physics] a graduate of the University, Mr J. Shearer, following his appointment as Lecturer in Physics after experience in Melbourne, undertook work on X-ray diffraction techniques. These were developed and applied in spectroscopy in crystal structure and in analysis. Mineralogical analyses of soil colloids were undertaken in association with the C.S.I.R. Individual research programmes lapsed during the war. Activity of the Physics department outside teaching duties was concentrated on three major war-time services: adjustment and reconditioning of binoculars and other optical instruments used by the Army and Navy, pyrometry service to industry, and camouflage. In addition to the use of individual members of the staff of the department as consultants on a variety of different problems—Professor Ross was a member of the Commonwealth Optical Munitions Panel, Deputy Director of Camouflage for the State and Consulting Physicist to the Royal Australian Navy—the work in optical munitions was by far the most extensive of the war-time activities of the department. Some 25 operatives were employed on a wide range of optical munition work, including the repair and tropic proofing of binoculars, production of graticules, jungle sights and glass gauges, etc.

Unlike the developments in Chemistry, this significant war-time teamwork in the Department of Physics did not carry over into a strong tradition of co-ordinated graduate research in the later 1940's, partly because it was predominantly in the character of services rather than research. The pyrometry services were continued, though they were subsequently taken over by government chemical laboratories. Individual members of the staff continued or began research work. These included that of Dr S. E. Williams, who joined the department in 1940 and after the war began a study of radio-frequency emission from the sun. This was followed after 1948 by the development of vacuum grating spectroscopy in the far ultra-violet region of the spectrum employing photomultiplier tubes as detectors. Also in the late 1940's a proton source was designed and constructed by Drs P. M. Jeffery and A. H. Morton, which led to the design and construction of a mass spectrometer. Dr L. N. D. Lucas, Senior Lecturer in Physics, and a member of the department's staff from 1946, began work on the design and construction of an electron diffraction camera. Researches that developed but which in the

course of time lapsed were the construction of a klystron, studies of moving ionospheric disturbances, the measurement of ozone in the upper atmosphere, and cosmic ray studies from the point of view particularly of latitudinal and directional effects.

In 1935 the Commonwealth X-ray and Radium Laboratory, in Melbourne, established a small laboratory at the University for the preparation of radon from radium for use in therapy. The Commonwealth provided the building and 400 mg of radium, and the plant was constructed by Dr R. R. Nimmo, then Lecturer in Physics. For several years the duties of radon preparation were shared by members of staff of the Physics Department. A graduate was later appointed and trained to do this work. After the war, when air services between Melbourne and Perth were improved in frequency and speed, it was deemed more economical to return the radium to Melbourne and fly to Perth radon seeds prepared in Melbourne. The radon laboratory building was subsequently used by the Chemistry Department in handling radioisotopes, until it was finally demolished and buried to make way for extensions to Law and Botany. [See Presenter's Note below.]

After the appointment of Professor C. J. Birkett Clews as the second Professor of Physics, X-ray diffraction, vacuum spectroscopy and electron diffraction were further developed as part of a programme of research on the physics of the solid state. The establishment of the Australian Institute of Nuclear Science and Engineering made it possible for universities to use the special facilities, especially the nuclear reactor HIFAR, at the Australian Atomic Energy Research Establishment at Lucas Heights. This permitted the scope of the department's work to include neutron diffraction investigations.

A major development in mass spectrometry was embarked upon in 1953 when the Carnegie Institution of Washington made a grant for $7,000 for the study of the age of Precambrian rocks of Australia. This work, under Dr P. M. Jeffery's guidance, won international recognition. Research of considerable interest by Dr J. B. Swan on the characteristic electron energy losses in metals provided information on the electron structure of the metals investigated and was supported by a grant of $26,000 from the United States Army Research Office. Other work in progress towards the close of the University's half century, when Professor Clews gave up his Chair of Physics to become Deputy Vice-Chancellor, included the study of the magnetic properties of alloys, and nuclear physics-solid state border line experiments on short-lived positron emitters. This and other research in physics was severely restricted by the lack of space. The opening early in 1962 of the much more spacious new Physics building was expected to promote a corresponding expansion in research activity under Professor Clews' successor.

[**Presenter's Note.** In fact, the buried remains of the original radon laboratory building were subsequently dug up again in the early 1990s, tested to ensure that there was no evidence of remnant radioactivity, and disposed of responsibly. This was done before the current new building (General Purpose Building No. 3) was constructed over/adjacent to the site.]